AN ASSESSMENT OF THE SUITABILITY OF A SOIL AMENDMENT POLYMER FOR TREE CROP GROWING

F O C Nwonwu*

Summary

Rooted cuttings of cottonwood (*Populus euroamericana*) were grown in three different soil mixes. Soil mix A contains 75% peat and 25% fine sand, mix B contains 75% peat, 25% fine and sand and 3.3kg of Viterra/m^3 of mix while mix C contains 50% peat and 50% fine sand. The plants were watered daily for four weeks and the height gains by plants measured. At the end of 4 weeks watering was stopped and two plants from mixes A and B were selected and observed for the length of survival without watering.

Results showed that height gains due to weeks of watering and soil mix are both significant at the 1% level with LSD (0.01) of 6.9cm and 5.5cm respectively. However, height gains for soil mixes A and C were higher than the Viterra treated soil mix B. Result on the water retaining ability of Viterra showed that the plant in Viterra treated mix continued normal growth for over 8 days while the plant in the untreated mix died 6 days while the plant in the untreated mix died 6 days after watering was stopped.

The results show that Viterra 2 does not aid the growth of plants but has a high capacity to hold water for gradual release to plants. It is therefore recommended not as an aid to plant growth but for water conservation especially in the arid and semi arid zones of the tropics.

Introduction

Foresters have continued to search for ways of establishing growing stock for more successfull planting programmes to minimize costs arising from plant mortality and plantation failure. The long gestation period associated with tree crop production calls for an ardent search for accurate knowledge to avoid making mistakes which may be very costly when they occur and may take many years to rectify if rectifiable. This quest for better knowledge often transcends disciplinary boundaries hence horticultural innovations designed for vegetables and ornamentals production could be borrowed and applied to tree crop production.

Techniques of raising growing stocks in containers as against the hitherto popular bare-root-stock method have become objects of considerable interest and activity for plantation managers in recent times. Apart from the relatively higher cost due to the containers, the techniques appear to have overwhelming advantages such as better root-to-shoot ratio, less transplant shock, possibility of introducing nutrients, pests and weed control inputs in the containers and amenability to mechanization.

* Rivers State University of Science and Technology Port Harcourt, Nigeria.

Viterra 2 hydrogel is a soil amendment polymer material which has been developed and is being used as a farming aid in agriculture. The manufacturers claim that Viterra 2 (1) has the ability to increase the available water in the container by as much as 50%, (2) improves the aeration in the growing medium and (3) absorbs 130 times its dry weight of water for gradual release to plants for better plant growth and development.

This study sets out to investigate some of the claims made by the manufacturers and to assess the applicability of Viterra 2 to forest tree growing. The study is carried out in three parts. The first part involves a growth study for different periods of watering using containerized cuttings of cotton wood (*Populus euroamericana*). The second part compares the height gains of the cuttings in three different soil mixes. Finally, the third part investigates the water retaining ability of Viterra 2.

Literature

Much of the work so far done on Viterra 2 is on its water holding capacity. Matro (1963) working with tomato transplant found that Viterra worked well as a moisture aid in the growing of transplants. Eikhof and King (1973) showed that water content of chrysanthemum plants was higher in containers with Viterra than in control without the polymer material on the fourteenth day after termination of watering. They further reported that Viterra can increase the period potted chrysanthemums and poinsettias lasted by 40% 100% without wilting. That Viterra 2 exhibits good water holding characteristics was confirmed by Ulahos and Boodley (1973) with the best result obtained when it is mixed with soild. Chen (1974) reported no difference in height between Viterra treated and untreated chrysanthemums but submitted that it induced early flowering in tomatoes. Thus far, literature is scanty if not nonexistent on the use of Viterra 2 for tree crop growing.

Materials and Methods

Experimental materials

Rooted cutting of cottonwood, fifteen plastic containers and three soil mixes were used. Soil mix A contains 75% peat and 25% fine sand, soil mix B is essentially soil mix A containing 3.3 kg of Viterra 2 per cubic metre of the mix while soil mix C will subsequently be referred to as the standard greenhouse mix.

Experimental Design

A randomized complete block (RCB) design was used in which the soil mixes constitute the block and the treatments (watering regimes) were randomly assigned to plants within blocks. Five containers were filled with each soil mix for a total of fifteen containers and rooted cuttings of cottonwood were planted in each container. The containerized plants were watered daily for four weeks and the height gains of plants were measured at the end of each week for four weeks. The gains in height due to watering regimes (treatments) and soil mixes (blocks) were tested for significance.

At the end of four weeks, watering was stopped for plants in soil mix A and B – the Viterra treated and untreated mixes respectively. Two widely separated but healthy looking plants were selected from each soil mix and observed to find out the length of time they would survive without watering as a measure of the water retaining ability of Viterra 2.

Results and Discussion

The height gains due to length of watering and soil mix are shown in Table 1.

Table 1. Height gains of plants (cm) for different weeks of watering and soil mixes.

Length of Watering (Treatment)	Soil Mix (Blocks)			
	A	B	C	Treatment Means**
1 Week	25.4	8.4	17.0	16.93
2 Weeks	26.7	15.8	14.7	19.07
3 Weeks	33.0	26.7	27.2	28.97
4 Weeks	36.8	24.4	25.4	28.87
Block Means**	30.48	18.83	21.08	

** Implies significance at the 1% level of probability.

Table 2. Ranked treatment and block means (cm)

Length of Watering (weeks)	3	4	2	1
Means	28.97^{A}	28.87^{B}	19.07^{C}	16.93^{C}
Soil mix (Blocks)	A	C	B	
Means	30.48^{A}	21.08^{B}	18.83^{B}	
LSD (0.01)		5.5 cm		

* Means with the same letters are not significantly different from each other but are significantly different from others. Treatments and blocks are ranked and compared differently.

Treatment Result

An F-test carried out on weekly height gains due to the different watering regimes showed significance at the 1% level with an LSD (0.01) of 6.9 cm (see Table 2). Further comparison of the means shows that the mean for three weeks of watering has the highest value followed by four weeks then two weeks and one week is the lowest. Using the LSD to compare the means it was found that means for four and three weeks are not significantly different from each other but are significantly different from the means for two weeks and one week of watering.

Block Result

The F-test carried out on the height gains for the three soil mixes shows significance at the 1% level with an LSD (0.01) of 5.5 cm (See Table 2). By visual observations the means of the Viterra treated soil mix is the lowest of the three means while the highest mean is obtained with the untreated soild mix A. Further comparison of the means using the LSD shows that the mean for the untreated soil mix A is significantly different from the means for soil mixes B and C. But the means of the Viterra treated and the standard greenhouse mixes are not significantly different from each other (see Table 2).

The implication of the result is that since means for untreated and treated soil mixes are significantly different and by visual observation the untreated mix has a higher value than the treated, it follows that the untreated mix is a better medium for plant growth. Also, since the means for the treated and greenhouse mixes show no significant difference and the latter has a higher value than the former it implies again that the greenhouse mix is a better medium for plant growth than the Viterra.

Water holding capacity

The result of the test on water holding capacity of Viterra 2 shows that the plant in the Viterra treated soil mix B maintained steady growth for over 8 days after watering was stopped, while plants in the untreated mix ceased to grow after 3 days of the cessation of watering and died 3 days later or 6 days from the day watering was stopped (see Table 3).

The result confirms that Viterra 2 has a high water holding capacity and that on contact with water it absorbs and holds many times its own volume of water which it gradually releases to the plant. On the other hand, the result shows that Viterra 2 does not aid the height growth of plants or cottonwood in particular. This agrees with the findings of chen (1974) who reported that plants grown in medium without Viterra and those with 3.2 grams/litre of Viterra were higher than those grown with 9.7 grams/litre of Viterra. This implies that high concentrations of the polymer may inhibit plant growth. Alternatively, it could be that although it is non-ionic Viterra could form a matrix with soil particles and trap certain elements in the matrix thus rendering them unavailable to plant roots (chen. 1974, Gladon, Personal communication).

Table 3 Readings after watering was stopped (cm)

Length of time (days)		Height of trees for Soil mixes	
		Viterra treated mix	Untreated mix
0	a	109.9	152.3
1		117.5	158.6
2		124.4	161.2
3	b	128.2	166.2
4		134.0	166.2
5		139.6	166.2
6	c	143.9	Dead
7		148.5	"
8		150.5	"

a. Watering was stopped here (4 weeks after planting) and the heights of plants are as shown.

b. Plant in the untreated soil mix showed no further growth from this day.

c. Plant in the untreated mix died on this day.

Conclusion

Much work that attest to the high water holding capacity of Viterra 2 hydrogel has been done. This study has further confirmed that Viterra 2 can hold many times its own volume of water for gradual release to the plant as examplified by the longer lasting and continued growth of plants in the Viterra treated soil mix after watering was stopped. But the growth comparison result shows that the material does not improve the growth of plants rather it possibly inhibits growth at higher concentrations. Consequently, it can only be recommended as an aid for soil water improvement in so far as it is economically feasible either as a component of the growing medium or as mulch for soil water improvement in the arid and semi-arid zones of the tropics to help conserve available water for gradual release to plants. Since Viterra 2 hydrogel may not be useful as an aid for nutrient uptake and therefore for the growth and development of plants, its usefulness in tree crop growing other than for water conservation is therefore doubtful.

REFERENCES

1. Chen, Iris, (1974). The effects of agricultural hydrogel concentrate 50g as a soil amendment on nutrient growth and development of certain plants and its influence on the

water-holding capacity of various media. Unpublished Masters Thesis, Department of Horticulture, Ohio State University, Columbus Ohio, U.S.A.

2. Eikhof, R.H. and P.A. King (1973). The influence of hydrophilia polymer on the water requirements and shelf life of container grown plants. National Agricultural Plastic Association, 11th National Conference, November, 8–9, 1973.

3. Gladon, Richard (Personal Communication) Department of Horticulture, Iowa State University, Ames., Iowa, U.S.A.

4. King, P.A. and R.H. Eikhof, (1973). The influence of isolubilized poly-(ethylene Oxide) in the soil-plant-water matrix . . . its effects on vegetable crops. National Agricultural Plastic Association, 11th National Conference, November 8–9, 1973.

5. Matro, G.J. (1963). (Monograph)

6. Ulahos, T. and J.W. Boodley, (1973). Hydrogel and its Potential use. Florists Review 152 (3939). 21–22.